

**REMARKS**

Claims 1 – 30 are pending in the subject application: claims 1 – 24 have been examined: claims 1 – 4 and 7 – 24 stand rejected, and claims 5 and 6 are indicated as containing allowable subject matter. By the above amendments, claims 1 – 5, 7 – 12, 14, and 16 have been amended, and new claims 25-30 have been added. Favorable reconsideration of the application and allowance of all of the pending claims are respectfully requested in view of the above amendments and the following remarks.

Applicant respectfully requests the Examiner to issue another PTO-892 form with the next communication listing U.S. Patent No. 6,549,527 (Tsutsui), since this document is relied upon by the Examiner but was apparently inadvertently omitted from the PTO-892 form supplied with the subject Office Action.

Claims 1 and 22 – 24 stand rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 3,986,123 to Tirro in view of Japanese Patent No. 8222934 (JP '934) and U.S. Patent No. 6,763,062 to Kohno. Further, claims 2 and 3 stand rejected as being unpatentable over Tirro, JP '934, Kohno, and U.S. Patent No. 5,583,562 to Birch et al.; claim 4 stands rejected over Tirro, JP '934, Kohno, Birch, and U.S. Patent No. 6,768,458 to Green et al.; claims 7 – 10 stand rejected over Tirro, JP '934, Kohno, and U.S. Patent No. 6,831,943 to Dabak et al.; claims 11 – 13 stand rejected over Tirro, JP '934, Kohno, and U.S. Patent No. 6,549,527 to Tsutsui et al.; claims 14 – 16 and 18 stand rejected over Tirro, JP '934, Kohno, and U.S. Patent No. 5,809,422 to Raleigh et al.; claim 17 stands rejected over Tirro, JP '934, Kohno, and U.S. Patent No. 5,937,348 to Cina et al.; and claims 19 – 21 stand rejected over Tirro, JP '934, Kohno, and U.S. Patent Application Publication No. 2002/0141478 to Ozluturk et al. Applicant respectfully traverses these rejections insofar as they apply to amended claim 1 and its dependent claims.

Independent claim 1 sets forth an apparatus for modulating and demodulating signals transmitted and received via an electronically steerable phased array antenna comprising a plurality of antenna elements. The claimed apparatus includes:

a baseband modulator configured to modulate outbound digital baseband signals to be transmitted via the phased array antenna;

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a baseband demodulator configured to demodulate incoming digital baseband signals generated from signals received via the phased array antenna; and

a shared baseband processor configured to receive digital baseband signals including the modulated outbound digital baseband signals and the incoming digital baseband signals, wherein the shared baseband processor applies phases to the digital baseband signals to account for both beamforming phase rotation of individual antenna elements and carrier phase rotation.

Notably, the apparatus of claim 1 requires a shared baseband processor that receives digital baseband signals including both modulated outbound digital baseband signals (destined to be transmitted via the phased array antenna) and incoming digital baseband signals (arriving from the phased array antenna). Further, the processor performs substantially the same operation on both the outbound and incoming digital baseband signals, namely, applying phases to the signals to account for both beamsteering and the carrier phase (i.e., the baseband carrier phase is applied to the digital signal). Moreover, claim 1 requires the baseband signals to be digital signals. Finally, claim 1 requires the beamforming phase rotation to be for individual antenna elements, which necessarily means that the processor processes digital baseband signals associated with individual antenna elements. In short, the claimed invention relates to system that performs digital beamforming at baseband in conjunction with application of carrier phases to digital baseband signals for both transmitted and received signals.

No combination of Tirro, JP '394, and Kohno would have rendered obvious the subject matter of claim 1, since none of these references discloses or suggests the above requirements of claim 1, whether considered singly or jointly. Tirro discloses a system for correcting polarization distortion in a satellite communication station that employs conjugate signal polarizations to support multiple communication channels. Tirro's processor ELT (cited by the Examiner) receives polarization distortion feedback information from received signals and uses the distortion information to control a predistorter (PRE) in the transmitting waveguide branch and a regenerative distortion corrector (CRT) in the receiving waveguide branch (see Fig. 3).

As a preliminary matter, Tirro's system is entirely analog; consequently, Tirro's processor ELT does not receive or process any digital baseband signals, as require by claim 1.

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Moreover, as clearly seen in Figs. 2 – 4, Tirro’s processor ELT is not a baseband processor at all and does not receive or process baseband signals (incoming, outgoing, digital or otherwise), as required by claim 1. More specifically, the distortion feedback sent to processor ELT from the distortion monitor is an intermediate frequency (IF) signal, not a baseband signal. This is clearly explained in Tirro’s Abstract as well as at column 4, lines 56 – 62. The received signals are not down-converted to baseband in Tirro’s system until further downstream (in unit CCA), such that the baseband signal is present at the inputs (e and g) to the receiver (CLR) (see col. 4, lines 62 – 67). Furthermore, the predistorter and distortion corrector controlled by Tirro’s processor ELT adjust the signal at the radio frequency (RF), not at baseband (see col. 4, lines 49 – 52 and col. 5, lines 11 – 13, which clarify that the signals are at microwave frequencies at the point of the predistorter and distortion corrector). In short, neither the input nor the outputs of Tirro’s processor ELT are at baseband. Thus, not only does Tirro’s processor ELT not receive or process baseband signals as required by claim 1; Tirro’s processor does not interact with baseband signals in any way.

JP ‘394 and Kohno do not compensate for the deficiencies of Tirro. JP ‘394 is relied upon for a general teaching of power, amplitude, and phase control, and Kohno is relied upon for a general teaching of steerable phased array antennas. However, like Tirro, neither of these documents discloses or suggests a shared baseband processor that receives outbound and incoming digital baseband signals and that applies phases to the digital baseband signals to account for both beamforming phase rotation of individual antenna elements and carrier phase rotation, as required by claim 1. In particular, Fig. 2 of Kohno clearly shows the various antenna element signals being combined at combiner 46 prior to being sent to the receiver for baseband processing. Likewise, Fig. 2 of Kohno shows the beamforming phases being applied to outgoing signals at RF, not baseband. Thus, no combination of Tirro, JP ‘394, and Kohno could have rendered obvious the shared baseband processor of claim 1. Moreover, claim 1 requires “beamforming phase rotation of individual antenna elements,” and none of these references, including Kohno, suggests digital baseband beamforming; thus, the subject matter of claim 1 would not have been (and could not have been) obvious from any combination of these

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documents for this additional reason. Accordingly, the Examiner is respectfully requested to reconsider and withdraw the rejection of claim 1.

The remaining documents are relied upon by the Examiner for teachings of subject matter recited in various dependent claims. Aside from whether these documents teach what the Examiner alleges or whether it would have been obvious to combine these documents in the manner proposed, none of these documents discloses or suggests the shared baseband processor as recited in claim 1 or the claimed subject matter discussed above in relation to Tirro, JP '394, and Kohno. Consequently, the subject matter of claim 1 and its dependent claims could not have been obvious from any combination of the cited documents. Accordingly, the Examiner is respectfully requested to reconsider and withdraw the rejections relating to the dependent claims.

New claim 25 (25/1) requires the shared baseband processor to adjust amplitudes of the digital baseband signals to perform power control and antenna element beam scaling. Similar limitations were originally recited in independent claim 1.

Claim 26 sets forth a method of processing an RF signal received via an electronically steerable phased array antenna comprising a plurality of antenna elements. The method includes: (a) separately down-converting the RF signal from each antenna element to an intermediate frequency (IF) signal; (b) separately analog-to-digital converting the IF signal from each antenna element; (c) separately digitally down-converting the digital IF signal from each antenna element to a digital baseband signal to form a set of parallel baseband signals from the plurality of antenna elements; (d) time multiplexing the set of parallel baseband signals to form a serial stream of digital baseband signals; (e) applying phases to the digital baseband signals in the serial stream to account for both carrier phase tracking and antenna element beamforming; and (f) performing beamforming by combining digital baseband signals respectively associated with the plurality of antenna elements. Dependent claim 27 (27/26) further requires decimating the digital IF signal from each antenna element to reduce the number of samples in the digital baseband signal. Dependent claim 28 (28/26) further requires generating baseband signals for a plurality of frequency channels from the digital IF signal of each antenna element, such that

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digital samples in the serial stream of digital baseband signals are associated with a particular antenna element and frequency channel.

New independent claim 29 sets forth a method of processing signals to be transmitted via an electronically steerable phased array antenna comprising a plurality of antenna elements. The method includes: (a) generating a stream of digital baseband signals representing data symbols to be transmitted via the phased array antenna, wherein digital baseband signals in the stream are associated with individual antenna elements; (b) applying phases to each of the digital baseband signals to account for both carrier phase rotation and antenna element beamforming; (c) demultiplexing the stream of digital baseband signals into a plurality of parallel signals respectively associated with individual antenna elements; (d) digitally up-converting the parallel signals to produce a plurality of digital intermediate frequency (IF) signals respectively associated with individual antenna elements; (e) digital-to-analog converting the digital IF signals to produce a plurality of IF signals respectively associated with individual antenna elements; and (f) up-converting the IF signals to RF signals for transmission via the phased array antenna. Dependent claim 30 (30/29) further requires that the phased array antenna simultaneously transmit signals on a plurality of frequency channels, and that the stream of digital baseband signals include signals associated with individual ones of the frequency channels. Support for new claims 25-30 is found throughout Applicant's specification (e.g., see Figs. 2 and 3). These claims are distinguishable from the cited prior art, since the prior art does not suggest the recited aspects of the methods, as is evident from the foregoing remarks.

The Examiner indicates that claims 5 and 6 would be allowable if rewritten in independent form to include all of the limitations of their parent claims and any intervening claims. The Examiner is requested to hold in abeyance the requirement of rewriting of claims 5 and 6 in independent form, until the Examiner has had an opportunity to reconsider (and withdraw) the rejection of parent claim 1 under 35 U.S.C. §103(a).

In view of the foregoing, Applicant respectfully requests the Examiner to find the application to be in condition for allowance with claims 1 – 30. However, if for any reason the Examiner feels that the application is not now in condition for allowance, the Examiner is

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respectfully requested to call the undersigned attorney to discuss any unresolved issues and to expedite the disposition of the application.

Filed concurrently herewith is a Petition (with payment) for an Extension of Time of One Month. Also filed concurrently herewith is payment of an excess claim fee in the amount of \$300 for six (6) new claims in excess of the twenty-four (24) previously paid for. Applicant hereby petitions for any extension of time which may be required to maintain the pendency of this case, and any required fee for such extension is to be charged to Deposit Account No. 05-0460.

Respectfully submitted,



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